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descendant of an ape, which would be only generically separable from the chimpanzee and the gorilla; and that while the last two are little modified descendants from a common stock, man's structure, in some respects, has been much modified,—but even man's deviation is mostly superficial and psychological.

THEO. GILL.

Washington, Aug. 5.

[We meant by the statement which Dr. Gill criticises, that the immediate exact ancestors of man are not known to paleontologists; and that the morphological evidence has not yet been so fully worked over as to afford definite conclusions as to the evolution of man. The elucidation of the exact affinities of man with various primates still awaits exhaustive study: that he is related to the anthropoid apes, is, of course, well established; but that he is more closely related to them than to any other primates has still to be proven. In suggesting a relationship between man and the monkeys, we meant rather to propound a question, than to advocate a conclusion. In reality, there is probably no essential difference between Dr. Gill's opinion, and the suggestion emitted in our comment, which our critic seems not to have understood as we intended. — ED.]

A mad stone.

Your question, Mr. Editor, having regard to Mr. Sampson's letter concerning a 'mad stone,' 'how did such a superstition arise?' admits of a ready answer. Many a porous stone, in good capillary condition, can suck a wound, not so effectively, perhaps, as the lips of Queen Eleanor, but still with considerable power. This fact is especially true in case the stone has been moistened so that close contact between it and the body may be secured, as well as continuity of the fluids, and evaporation from the external surface of the stone, to actuate the capillary flow. Familiar applications of the principle are seen when the country-boy puts a dab of mud upon the spot where a hornet has stung him to compose the pain; and when the housewife uses French chalk, or soap-stone dust, or wet plaster-of-Paris, or, better yet, clay moistened with naphtha, ether, or oil of turpentine to draw out a grease-spot from clothing or from the floor. Thus much for the basis of the 'superstition.' It is assuredly easy to conceive withal that 'mad stones' may have existed of such chemical composition, or charged with such chemical substances, that they could act as germicides as well as absorbents. Indeed, we have already in that most sovereign of balms, powdered chalk for a mosquito bite, something so nearly akin to the ideal mad stone, that your correspondent was more than justified in according to the matter his portion of that careful attention which Arago did extol.

F. H. STORER.

THE KONGO FREE STATE.

MR. STANLEY has given a history of the planting of this state, its growth to the present time, and the recognition of its flag and sovereignty by the powers of Europe and America, at the Berlin conference. His book has been supplemented by reports from French and Portuguese travellers; from Lieut. Cameron of the English army, who crossed Africa

from the east to the west a little below the valley of the Kongo; from Mr. W. H. Tisdel, the agent sent by our government to the Kongo; and from Admiral English, commander of our fleet on the African coast. These reports, though somewhat conflicting, can be reconciled, and the truth ascertained.

The Kongo free state, by the terms of the Berlin convention, controls a narrow strip on the northern banks of the Lower Kongo, from the ocean to Stanley Pool; thence the territory extends north-east to between the fifth and sixth degrees of north latitude, and south below the eleventh degree of south latitude, and east to within a few hundred miles of the Indian Ocean, including in its limits nearly all the water-shed of the Kongo and its branches.

The river is navigable from the ocean to Vivi. Between Stanley Pool and Vivi, 235 miles, there is a fall of 1,200 feet, with 80 miles of navigable water between the falls. There are a large number of navigable branches running into the Kongo, and steam-launches have sailed on the Kongo and these branches nearly 1,500 miles. Mr. Stanley estimates, indeed, that there are over 5,000 miles of uninterrupted navigation on them; and that, in addition, the navigable waters of other tributaries would probably bring the total to about 20,000 miles: these estimates cannot be fully relied upon, but there is sufficient evidence to prove that the navigable waters of the Kongo exceed those of any other river in the world.

The land in the eastern part of the watershed of the Kongo is between 4,000 and 5,000 feet in height, falling at first pretty rapidly, and then more gradually, into the great valley of the Kongo, about 1,500 feet above the sea-level.

As the river rises in the east, runs to the west near the Equator, its valley has nearly the same climate, growing more temperate towards the sources of the river. The whole area is abundantly supplied with rainfall.

The outlets for the trade of this vast region have hitherto been south through the Portuguese territory to the Atlantic Ocean at Benguela, or else north-west through the French possessions to the valley of the Ogowé. The Kongo offers the shortest route to the ocean, but the river has cut its way through the chains of mountains; while the Kwilu Niadi, in the territory of the association, and the Ogowé, follow natural valleys, and reach the ocean by longer and easier routes.

Mr. Stanley constructed a road around these falls. It crosses a succession of valleys and steep hills, some one thousand feet in height.

In the valleys are streams, lowlands, and swamps; and the lowland is so rich, and the growth so luxuriant, that the grass and cane attain a height of from eight to ten feet in a short time, and completely hide and obstruct the road, so that it is almost impossible to maintain it in a passable condition. As there are no beasts of burden in the country, all goods are carried around the falls on the heads of porters, or pulled up the steep hills.

A small steamer, the Stanley, of thirty tons burden, constructed in sections, arrived at Vivi nearly two years ago. A force was at once organized to move these sections to Stanley Pool; but all efforts have been fruitless, and the different sections now lie rusting in the valleys or on the hills.

Two hundred and fifty thousand dollars are annually paid for porters between Stanley Pool and the coast, by the International association, native traders, and three missions.

The expense of transporting merchandise and stores from the ocean to Stanley Pool, exchanging them for the products of equatorial Africa, and carrying these to the ocean, exceeds the value of the articles when delivered at the stations on the coast. Mr. Stanley admits this fact, and says that "the Kongo Basin is not worth a two-shilling piece in its present state."

The only way in which the products of equatorial Africa can be conveyed from the Kongo to the ocean, is by means of a railroad constructed either down the Kwilu, the Ogowé, or the Kongo. The Kongo railroad will probably cost much more per mile than one by either of the other routes; but, as it is the shortest, the total expense of construction will be less, while the operating expenses will be much less.

Whenever the merchants and bankers of Europe and America are convinced that this road will pay, it will be built, and the settlement and civilization of Africa commenced.

Little difficulty has been found in procuring laborers for the construction of the Panama railroad and canal, and no greater difficulty will be found in the construction of this road.

It therefore becomes necessary to ascertain if the soil is fertile, and yields bountifully the products that are required in temperate regions, and if the climate permits cultivation and trade to be carried on under the supervision of white men.

The steamers of the association have visited many tribes on the banks of the Kongo, establishing stations, and examining the bottom lands of the Kongo and its branches. But

they know little of the great valley of the Kongo and its tributaries. It is believed that the soil is generally fertile, though there are probably, both north and south of the river, large lakes and tracts of low and swampy land. But a long time must elapse before equatorial Africa is thoroughly known.

The soil in the valleys is exceedingly rich, and yields all the products of equatorial countries. Cattle are not found; but, as they are raised in large quantities on the eastern part of the water-shed, they can probably be raised in the valley. Ivory, palm-oil, rubber, dye-stuffs, and gums are abundant; and tea, coffee, cotton, pepper, spices, and sugar can be grown to an almost illimitable extent.

A rich and fertile soil is of little value without laborers to till it. These cannot be brought from abroad, but must be found in the country itself. The natives of Africa are naturally improvident, and work only when compelled by the whip of the master, or necessity. They have few wants, require little clothing, the ground yields spontaneously enough for their support, the rivers abound in fish, and the women do all the work.

The early laborers employed by Mr. Stanley were Kurmen from the west coast and Zanzibaris from the east coast; but Mr. Stanley has gradually substituted native labor, and now fifteen hundred natives are on the pay-roll of the association. As the negro is taught the wants of civilized life, he will, by slow degrees, be induced to work; but a long time must elapse before the lands of equatorial Africa are settled and cultivated to any great extent.

It will be impossible to carry on trade with Africa, or civilize the country, without the presence of white men.

The western coast of Africa is the most unhealthy country in the world; and the loss of life at the stations at the mouth of the Kongo, and in the expedition of Capt. Tuckey, seemed to prove that the valley of the Kongo was equally unhealthy. Reports from returned employees of the association, and others, confirm this opinion. They say that a large number of the foreign employees have died, while many others, enfeebled by disease, have returned home.

It is evident, from the account of Mr. Stanley, that there has been a large proportion of deaths and disabilities among the employees of the association; that exposure or intemperance, which in Europe causes only temporary inconvenience, is followed on the Kongo by fever, and often by death, in a very short time. The statistics are insufficient to enable

us to form a correct judgment in regard to the mortality.

Mr. Stanley was unfortunate in the selection of several of the stations, particularly those at Vivi and Stanley Pool. They were located on high ground, and supposed to be peculiarly healthy; but at these stations the hills on the two sides of the river converge, and the cool breezes from the river and the valley blow over the stations as through the mouth of a funnel: and sickness and death are much more frequent than in low stations in the valley of the river protected from the wind by the hills or trees.

Mr. Stanley asserts, and we think he is correct, that when the sanitary conditions are better understood, and the exposures incident to the settlement of a new country overcome, proper food obtained, with temperance in eating and drinking, a man can accomplish as much work in equatorial Africa as in temperate Europe; provided, as stated on another page of *Science*, he returns home every eighteen months for a vacation of three or four months.

The death-rate is always high in new countries. In New England, and in the temperate regions of America, as well as in torrid zones, new settlements are always unhealthy, and great mortality prevails; and not until permanent settlements are made can we pronounce upon the healthiness of any climate. We believe that equatorial Africa, being nearly two thousand feet above the level of the sea, will be less unhealthy than India, or many other countries where white men live, and carry on a large and successful trade.

The association has already planted twenty-two stations up and down the valley of the Kongo, and expect to plant and maintain other stations every fifty or one hundred miles on these waters. The natives within the influence of these settlements are beginning to labor, and bring in their productions to the settlements. A small amount from each station will make a large foreign export, sufficient to support a railroad from Stanley Pool to the ocean.

The stations are now ready, but the merchants cannot successfully establish stores for trading with the natives until the railroad is built. The cost of the railroad is estimated by Mr. Stanley at \$5,000,000 in the body of his book, and at \$7,500,000 in the appendix.

All that equatorial Africa now requires, is the construction of the railroad from Stanley Pool to Vivi; and we trust and believe that the same good judgment, executive ability,

and energy, which have won success for Mr. Stanley's other undertakings, will enable him to raise the funds for this enterprise, open the heart of Africa, and accomplish the objects of the association. GARDINER G. HUBBARD.

COMPOSITE PORTRAITURE.

THE process of composite photography has been applied to the solution of two problems: 1. Given a series of objects having in common an interesting characteristic, to find a single type which shall represent the whole group. 2. Given a series of representations of the same object, to find a single representation which shall give a superior effect by combining the strong points, and neglecting the defects, of each of the series. The latter problem is by far the simpler. The composite of six medallion heads of Alexander the Great may be taken to represent the real Alexander better than any one of the originals, because the probability of the six artists having introduced the same inaccuracy is very small. In the first problem, however, we are introducing an essentially new face, — a type representing *par excellence* the peculiar characteristic for which the originals were grouped together. In combining the portraits of criminals, the object is to get a type of criminality; in combining the portraits of national academicians, one of recognized scientific ability.

Other methods of producing a type are when the artist puts on paper the general effect of more or less unconscious observation of physical peculiarities in the class of persons represented; or when the anthropologist selects among a number of savages, for instance, one who was judged to have all the distinctive marks of his tribe in neither an exaggerated nor a deficient degree, and yet combined with them no individual eccentricities, — in short, that much-talked-of average man, whom one does not meet every day. Composite photography aims to take this process out of the hands of erring judgment and vague imagination, and reduce the art of type-getting to a mechanical one of combining photographs.

In several cases, when various images have been combined to elicit a type, it has happened that the resultant has been remarkably similar to one individual of the group represented. This was strikingly illustrated in the portraits published in *Science*, No. 118. Mr. Galton mentions, that in one such case he took a second composite, omitting the face which resembled the first composite, and the two pictures thus